

## Aluminum Electrolytic Capacitors Radial High Temperature Standard

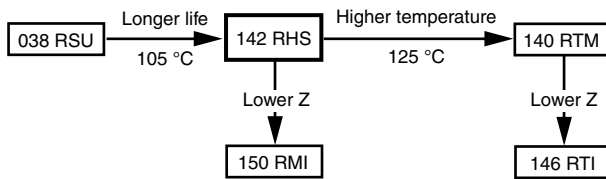
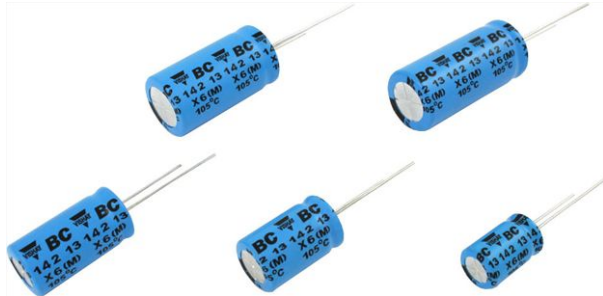


Fig. 1

QUICK REFERENCE DATA	
DESCRIPTION	VALUE
Nominal case sizes (Ø D x L in mm)	5 x 11 to 18 x 40
Rated capacitance range, C <sub>R</sub>	1 µF to 22 000 µF
Tolerance on C <sub>R</sub>	± 20 %
Rated voltage range, U <sub>R</sub>	10 V to 450 V
Category temperature range	-40 °C to +105 °C
Endurance test at 105 °C	2000 h
Useful life at 105 °C	2500 h
Useful life at 40 °C, 1.6 x I <sub>R</sub> applied	140 000 h
Shelf life at 0 V, 105 °C	1000 h
Based on sectional specification	IEC 60384-4 / EN130300
Climatic category IEC 60068	40 / 105 / 56

### FEATURES

- Useful life: 2500 h at 105 °C
- Miniaturized, high CV-product per unit volume
- Charge and discharge proof
- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case, insulated with a blue sleeve
- Pressure relief for case Ø D ≥ 6.3 mm
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

### APPLICATIONS

- Industrial, telecom and domestic appliances
- Decoupling, smoothing, filtering, buffering in SMPS
- Portable and mobile equipment (small size, low mass)

### MARKING

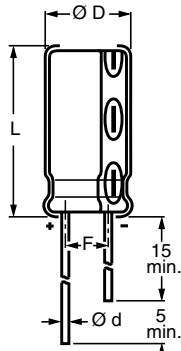
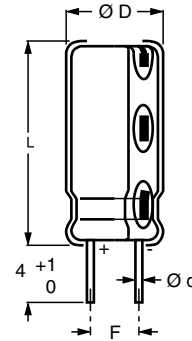
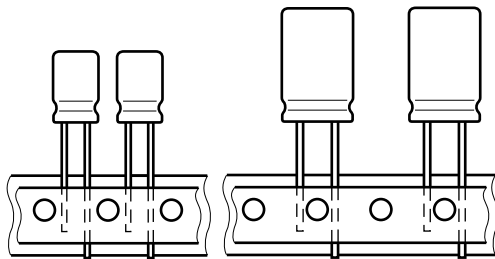
The capacitors are marked (where possible) with the following information:

- Rated capacitance (in µF)
- Tolerance on rated capacitance, code letter in accordance with IEC 60062 (M for ± 20 %)
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Code indicating factory of origin
- Name or logo of manufacturer
- Negative terminal identification
- Series number (142)



SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm)							
C <sub>R</sub> (μF)	U <sub>R</sub> (V)						
	10	16	25	35	50	63	100
1.0	→	→	→	→	→	→	→
2.2	→	→	→	→	→	→	5 x 11
4.7	→	→	→	→	→	5 x 11	6.3 x 11
10	→	→	→	→	→	5 x 11	8 x 12
22	→	→	→	→	5 x 11	6.3 x 11	8 x 12
33	→	→	→	→	→	6.3 x 11	10 x 12
47	→	→	5 x 11	5 x 11	6.3 x 11	8 x 12	10 x 16
100	→	5 x 11	6.3 x 11	6.3 x 11	8 x 12	10 x 12	10 x 20
220	→	6.3 x 11	8 x 12	8 x 12	10 x 12	10 x 16	12.5 x 25
330	6.3 x 11	8 x 12	→	10 x 12	10 x 16	10 x 20	16 x 25
470	8 x 12	10 x 12	10 x 12	10 x 16	12.5 x 20	12.5 x 20	16 x 31
1000	10 x 12	10 x 16	10 x 20	12.5 x 20	12.5 x 25	16 x 25	18 x 40
2200	10 x 20	12.5 x 20	12.5 x 25	16 x 25	16 x 35	18 x 40	-
3300	→	12.5 x 25	16 x 25	16 x 31	18 x 35	-	-
4700	12.5 x 25	16 x 25	16 x 31	18 x 35	-	-	-
6800	16 x 25	16 x 31	18 x 35	-	-	-	-
10 000	16 x 31	18 x 31	-	-	-	-	-
22 000	18 x 40	-	-	-	-	-	-

SELECTION CHART FOR C <sub>R</sub> , U <sub>R</sub> , AND RELEVANT NOMINAL CASE SIZES (∅ D x L in mm)					
C <sub>R</sub> (μF)	U <sub>R</sub> (V)				
	200	250	350	400	450
1.0	5 x 11	5 x 11	6.3 x 11	6.3 x 11	8 x 12
2.2	6.3 x 11	6.3 x 11	8 x 12	8 x 12	10 x 12
4.7	8 x 12	8 x 12	10 x 12	10 x 12	10 x 16
10	10 x 12	10 x 12	10 x 16	10 x 20	12.5 x 20
22	10 x 16	10 x 20	12.5 x 20	12.5 x 25	16 x 20
33	→	12.5 x 20	→	→	16 x 25
47	12.5 x 20	12.5 x 25	16 x 25	16 x 31	16 x 35
100	16 x 25	16 x 31	18 x 35	18 x 40	-
220	18 x 35	-	-	-	-

**DIMENSIONS in millimeters AND AVAILABLE FORMS**

 Fig. 2 - Form CA  
Long leads

 Fig. 3 - Form CB  
Cut leads


Dimensions of lead space F see Table 2

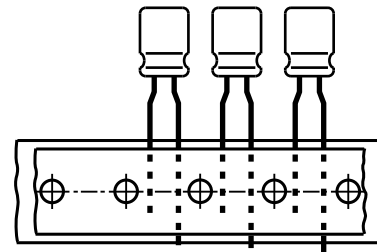
 Fig. 4 - Form TNA, Form TFA  
Taped in box (ammopack), straight leads

 Case  $\varnothing D = 5 \text{ mm to } 8 \text{ mm};$   
Lead space F is 5 mm

 Fig. 5 - Form TFA  
Taped in box (ammopack), formed leads

**Table 1**

<b>DIMENSIONS in millimeters, MASS AND PACKAGING QUANTITIES</b>									
NOMINAL CASE SIZE $\varnothing D \times L$	CASE CODE	$\varnothing d$	$\varnothing D_{max}$	$L_{max}$	F	MASS (g)	PACKAGING QUANTITIES		
							FORM CA	FORM CB	FORM TFA, TNA
5 x 11	11	0.5	5.5	12.5	$2.0 \pm 0.5$	$\approx 0.4$	5000	-	2000
6.3 x 11	12	0.5	6.8	12.5	$2.5 \pm 0.5$	$\approx 0.6$	5000	-	2000
8 x 12	13	0.6	8.5	13.0	$3.5 \pm 0.5$	$\approx 1.1$	5000	-	1000
10 x 12	14	0.6	10.5	13.5	$5.0 \pm 0.5$	$\approx 1.6$	3000	1000	500
10 x 16	15	0.6	10.5	17.5	$5.0 \pm 0.5$	$\approx 1.9$	2500	1000	500
10 x 20	16	0.6	10.5	22.0	$5.0 \pm 0.5$	$\approx 2.2$	2000	800	500
12.5 x 20	17	0.6	13.0	22.0	$5.0 \pm 0.5$	$\approx 4.0$	1500	400	300
12.5 x 25	18	0.6	13.0	27.0	$5.0 \pm 0.5$	$\approx 5.0$	1000	400	300
16 x 20	19a	0.8	16.5	22.0	$7.5 \pm 0.5$	$\approx 6.0$	1000	200	200
16 x 25	19	0.8	16.5	27.0	$7.5 \pm 0.5$	$\approx 8.0$	750	200	200
16 x 31	20	0.8	16.5	33.5	$7.5 \pm 0.5$	$\approx 9.0$	600	200	200
16 x 35	21	0.8	16.5	37.5	$7.5 \pm 0.5$	$\approx 11.0$	500	200	-
18 x 31	1831	0.8	18.5	33.5	$7.5 \pm 0.5$	$\approx 12.5$	400	150	-
18 x 35	22	0.8	18.5	37.5	$7.5 \pm 0.5$	$\approx 14.5$	400	150	-
18 x 40	23	0.8	18.5	42.0	$7.5 \pm 0.5$	$\approx 16.0$	400	150	-

**Note**

- For detailed tape dimensions please refer to packaging information: [www.vishay.com/doc?28360](http://www.vishay.com/doc?28360)



ELECTRICAL DATA	
SYMBOL	DESCRIPTION
$C_R$	Rated capacitance at 100 Hz, tolerance $\pm 20\%$
$I_R$	Rated RMS ripple current at 100 Hz, 105 °C
$I_{L2}$	Max. leakage current after 2 min at $U_R = 10\text{ V}$ to 100 V
$I_{L5}$	Max. leakage current after 5 min at $U_R = 200\text{ V}$ to 450 V
$\tan \delta$	Max. dissipation factor at 100 Hz

**ORDERING EXAMPLE**

Electrolytic capacitor 142 series

470  $\mu\text{F}$  / 25 V;  $\pm 20\%$

Nominal case size:  $\varnothing 10\text{ mm} \times 12\text{ mm}$ ; Form TFA

Ordering Code: MAL214236471E3

**Note**

- Unless otherwise specified, all electrical values in Table 2 apply at  $T_{\text{amb}} = 20\text{ °C}$ ,  $P = 86\text{ kPa}$  to 106 kPa,  $\text{RH} = 45\%$  to 75 %.

Table 2

ELECTRICAL DATA AND ORDERING INFORMATION													
$U_R$ (V)	$C_R$ 100 Hz ( $\mu\text{F}$ )	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	$I_R$ 100 Hz 105 °C (mA)	$I_{L2}$ 2 min ( $\mu\text{A}$ )	$\tan \delta$ 100 Hz	ORDERING CODE MAL2142...							
						BULK PACKAGING				TAPED AMMOPACK			
						LONG LEADS		CUT LEADS		FORM TNA		FORM TFA	
						FORM CA	F (mm)	FORM CB	F (mm)	FORM TNA	F (mm)	FORM TFA	F (mm)
10	330	6.3 x 11	200	33	0.20	54331E3	2.5	-	-	74331E3	2.5	34331E3	5.0
	470	8 x 12	290	47	0.20	54471E3	3.5	-	-	74471E3	3.5	34471E3	5.0
	1000	10 x 12	460	100	0.20	54102E3	5.0	64102E3	5.0	-	-	34102E3	5.0
	2200	10 x 20	760	220	0.22	54222E3	5.0	64222E3	5.0	-	-	34222E3	5.0
	4700	12.5 x 25	1260	470	0.26	54472E3	5.0	64472E3	5.0	-	-	34472E3	5.0
	6800	16 x 25	1690	680	0.28	54682E3	7.5	64682E3	7.5	-	-	34682E3	7.5
	10 000	16 x 31	2120	1000	0.30	54103E3	7.5	64103E3	7.5	-	-	34103E3	7.5
	22 000	18 x 40	3100	2200	0.32	54223E3	7.5	64223E3	7.5	-	-	-	-
16	100	5 x 11	110	16	0.16	55101E3	2.0	-	-	75101E3	2.5	35101E3	5.0
	220	6.3 x 11	190	35	0.16	55221E3	2.5	-	-	75221E3	2.5	35221E3	5.0
	330	8 x 12	270	53	0.16	55331E3	3.5	-	-	75331E3	3.5	35331E3	5.0
	470	10 x 12	370	75	0.16	55471E3	5.0	65471E3	5.0	-	-	35471E3	5.0
	1000	10 x 16	560	160	0.16	55102E3	5.0	65102E3	5.0	-	-	35102E3	5.0
	2200	12.5 x 20	920	352	0.18	55222E3	5.0	65222E3	5.0	-	-	35222E3	5.0
	3300	12.5 x 25	1170	528	0.20	55332E3	5.0	65332E3	5.0	-	-	35332E3	5.0
	4700	16 x 25	1480	752	0.22	55472E3	7.5	65472E3	7.5	-	-	35472E3	7.5
	6800	16 x 31	1930	1088	0.24	55682E3	7.5	65682E3	7.5	-	-	35682E3	7.5
10 000	18 x 31	2330	1600	0.26	55103E3	7.5	65103E3	7.5	-	-	-	-	
25	47	5 x 11	97	12	0.14	56479E3	2.0	-	-	76479E3	2.5	36479E3	5.0
	100	6.3 x 11	142	25	0.14	56101E3	2.5	-	-	76101E3	2.5	36101E3	5.0
	220	8 x 12	236	55	0.14	56221E3	3.5	-	-	76221E3	3.5	36221E3	5.0
	470	10 x 12	380	118	0.14	56471E3	5.0	66471E3	5.0	-	-	36471E3	5.0
	1000	10 x 20	680	250	0.14	56102E3	5.0	66102E3	5.0	-	-	36102E3	5.0
	2200	12.5 x 25	1110	550	0.16	56222E3	5.0	66222E3	5.0	-	-	36222E3	5.0
	3300	16 x 25	1440	825	0.18	56332E3	7.5	66332E3	7.5	-	-	36332E3	7.5
	4700	16 x 31	1710	1175	0.20	56472E3	7.5	66472E3	7.5	-	-	36472E3	7.5
	6800	18 x 35	2160	1700	0.22	56682E3	7.5	66682E3	7.5	-	-	-	-



ELECTRICAL DATA AND ORDERING INFORMATION													
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE Ø D x L (mm)	I <sub>R</sub> 100 Hz 105 °C (mA)	I <sub>L2</sub> 2 min (μA)	tan δ 100 Hz	ORDERING CODE MAL2142...							
						BULK PACKAGING				TAPED AMMOPACK			
						LONG LEADS		CUT LEADS		FORM TNA		FORM TFA	
						FORM CA	F (mm)	FORM CB	F (mm)	FORM TNA	F (mm)	FORM TFA	F (mm)
35	47	5 x 11	90	16	0.12	50479E3	2.0	-	-	70479E3	2.5	30479E3	5.0
	100	6.3 x 11	150	35	0.12	50101E3	2.5	-	-	70101E3	2.5	30101E3	5.0
	220	8 x 12	270	77	0.12	50221E3	3.5	-	-	70221E3	3.5	30221E3	5.0
	330	10 x 12	350	116	0.12	50331E3	5.0	60331E3	5.0	-	-	30331E3	5.0
	470	10 x 16	460	165	0.12	50471E3	5.0	60471E3	5.0	-	-	30471E3	5.0
	1000	12.5 x 20	810	350	0.12	50102E3	5.0	60102E3	5.0	-	-	30102E3	5.0
	2200	16 x 25	1260	770	0.14	50222E3	7.5	60222E3	7.5	-	-	30222E3	7.5
	3300	16 x 31	1420	1155	0.16	50332E3	7.5	60332E3	7.5	-	-	30332E3	7.5
	4700	18 x 35	1900	1645	0.18	50472E3	7.5	60472E3	7.5	-	-	-	-
50	22	5 x 11	78	11	0.10	51229E3	2.0	-	-	71229E3	2.5	31229E3	5.0
	47	6.3 x 11	120	24	0.10	51479E3	2.5	-	-	71479E3	2.5	31479E3	5.0
	100	8 x 12	188	50	0.10	51101E3	3.5	-	-	71101E3	3.5	31101E3	5.0
	220	10 x 12	240	110	0.10	51221E3	5.0	61221E3	5.0	-	-	31221E3	5.0
	330	10 x 16	410	165	0.10	51331E3	5.0	61331E3	5.0	-	-	31331E3	5.0
	470	12.5 x 20	530	235	0.10	51471E3	5.0	61471E3	5.0	-	-	31471E3	5.0
	1000	12.5 x 25	950	500	0.10	51102E3	5.0	61102E3	5.0	-	-	31102E3	5.0
	2200	16 x 35	1470	1100	0.12	51222E3	7.5	61222E3	7.5	-	-	-	-
	3300	18 x 35	1770	1650	0.14	51332E3	7.5	61332E3	7.5	-	-	-	-
63	4.7	5 x 11	36	3	0.09	58478E3	2.0	-	-	78478E3	2.5	38478E3	5.0
	10	5 x 11	54	6	0.09	58109E3	2.0	-	-	78109E3	2.5	38109E3	5.0
	22	6.3 x 11	86	14	0.09	58229E3	2.5	-	-	78229E3	2.5	38229E3	5.0
	33	6.3 x 11	100	21	0.09	58339E3	2.5	-	-	78339E3	2.5	38339E3	5.0
	47	8 x 12	141	30	0.09	58479E3	3.5	-	-	78479E3	3.5	38479E3	5.0
	100	10 x 12	235	63	0.09	58101E3	5.0	68101E3	5.0	-	-	38101E3	5.0
	220	10 x 16	335	139	0.09	58221E3	5.0	68221E3	5.0	-	-	38221E3	5.0
	330	10 x 20	510	208	0.09	58331E3	5.0	68331E3	5.0	-	-	38331E3	5.0
	470	12.5 x 20	640	296	0.09	58471E3	5.0	68471E3	5.0	-	-	38471E3	5.0
1000	16 x 25	930	630	0.09	58102E3	7.5	68102E3	7.5	-	-	38102E3	7.5	
2200	18 x 40	2340	1380	0.09	58222E3	7.5	68222E3	7.5	-	-	-	-	
100	2.2	5 x 11	30	3	0.08	59228E3	2.0	-	-	79228E3	2.5	39228E3	5.0
	4.7	6.3 x 11	40	5	0.08	59478E3	2.5	-	-	79478E3	2.5	39478E3	5.0
	10	8 x 12	66	10	0.08	59109E3	3.5	-	-	79109E3	3.5	39109E3	5.0
	22	8 x 12	99	22	0.08	59229E3	3.5	-	-	79229E3	3.5	39229E3	5.0
	33	10 x 12	148	33	0.08	59339E3	5.0	69339E3	5.0	-	-	39339E3	5.0
	47	10 x 16	180	47	0.08	59479E3	5.0	69479E3	5.0	-	-	39479E3	5.0
	100	10 x 20	265	100	0.08	59101E3	5.0	69101E3	5.0	-	-	39101E3	5.0
	220	12.5 x 25	440	220	0.08	59221E3	5.0	69221E3	5.0	-	-	39221E3	5.0
	330	16 x 25	540	330	0.08	59331E3	7.5	69331E3	7.5	-	-	39331E3	7.5
470	16 x 31	715	470	0.08	59471E3	7.5	69471E3	7.5	-	-	39471E3	7.5	
1000	18 x 40	985	1000	0.08	59102E3	7.5	69102E3	7.5	-	-	-	-	



ELECTRICAL DATA AND ORDERING INFORMATION													
U <sub>R</sub> (V)	C <sub>R</sub> 100 Hz (μF)	NOMINAL CASE SIZE Ø D x L (mm)	I <sub>R</sub> 100 Hz 105 °C (mA)	I <sub>L2</sub> 2 min (μA)	tan δ 100 Hz	ORDERING CODE MAL2142...							
						BULK PACKAGING				TAPED AMMOPACK			
						LONG LEADS		CUT LEADS		FORM TNA		FORM TFA	
						FORM CA	F (mm)	FORM CB	F (mm)	FORM TNA	F (mm)	FORM TFA	F (mm)
200	1.0	5 x 11	18	21	0.14	52108E3	2.0	-	-	72108E3	2.5	32108E3	5.0
	2.2	6.3 x 11	30	28	0.14	52228E3	2.5	-	-	72228E3	2.5	32228E3	5.0
	4.7	8 x 12	54	43	0.14	52478E3	3.5	-	-	72478E3	3.5	32478E3	5.0
	10	10 x 12	94	65	0.14	52109E3	5.0	62109E3	5.0	-	-	32109E3	5.0
	22	10 x 16	142	113	0.14	52229E3	5.0	62229E3	5.0	-	-	32229E3	5.0
	47	12.5 x 20	250	213	0.14	52479E3	5.0	62479E3	5.0	-	-	32479E3	5.0
	100	16 x 25	485	425	0.14	52101E3	7.5	62101E3	7.5	-	-	32101E3	7.5
	220	18 x 35	835	905	0.14	52221E3	7.5	62221E3	7.5	-	-	-	-
250	1.0	5 x 11	16	23	0.17	51083E3	2.0	-	-	71083E3	2.5	31083E3	5.0
	2.2	6.3 x 11	35	32	0.17	52283E3	2.5	-	-	72283E3	2.5	32283E3	5.0
	4.7	8 x 12	60	50	0.17	54783E3	3.5	-	-	74783E3	3.5	34783E3	5.0
	10	10 x 12	92	75	0.17	51093E3	5.0	61093E3	5.0	-	-	31093E3	5.0
	22	10 x 20	215	135	0.17	52293E3	5.0	62293E3	5.0	-	-	32293E3	5.0
	33	12.5 x 20	315	190	0.17	53393E3	5.0	63393E3	5.0	-	-	33393E3	5.0
	47	12.5 x 25	350	260	0.17	54793E3	5.0	64793E3	5.0	-	-	34793E3	5.0
	100	16 x 31	530	525	0.17	51013E3	7.5	61013E3	7.5	-	-	31013E3	7.5
350	1.0	6.3 x 11	23	26	0.20	51085E3	2.5	-	-	71085E3	2.5	31085E3	5.0
	2.2	8 x 12	41	38	0.20	52285E3	3.5	-	-	72285E3	3.5	32285E3	5.0
	4.7	10 x 12	65	58	0.20	54785E3	5.0	64785E3	5.0	-	-	34785E3	5.0
	10	10 x 16	105	95	0.20	51095E3	5.0	61095E3	5.0	-	-	31095E3	5.0
	22	12.5 x 20	210	179	0.20	52295E3	5.0	62295E3	5.0	-	-	32295E3	5.0
	47	16 x 25	365	354	0.20	54795E3	7.5	64795E3	7.5	-	-	34795E3	7.5
	100	18 x 35	505	725	0.20	51015E3	7.5	61015E3	7.5	-	-	-	-
400	1.0	6.3 x 11	21	27	0.25	51086E3	2.5	-	-	71086E3	2.5	31086E3	5.0
	2.2	8 x 12	39	41	0.25	52286E3	3.5	-	-	72286E3	3.5	32286E3	5.0
	4.7	10 x 12	70	63	0.25	54786E3	5.0	64786E3	5.0	-	-	34786E3	5.0
	10	10 x 20	125	105	0.25	51096E3	5.0	61096E3	5.0	-	-	31096E3	5.0
	22	12.5 x 25	235	201	0.25	52296E3	5.0	62296E3	5.0	-	-	32296E3	5.0
	47	16 x 31	390	401	0.25	54796E3	7.5	64796E3	7.5	-	-	34796E3	7.5
	100	18 x 40	530	825	0.25	51016E3	7.5	61016E3	7.5	-	-	-	-
450	1.0	8 x 12	27	29	0.25	57108E3	3.5	-	-	77108E3	3.5	37108E3	5.0
	2.2	10 x 12	48	45	0.25	57228E3	5.0	67228E3	5.0	-	-	37228E3	5.0
	4.7	10 x 16	75	67	0.25	57478E3	5.0	67478E3	5.0	-	-	37478E3	5.0
	10	12.5 x 20	145	115	0.25	57109E3	5.0	67109E3	5.0	-	-	37109E3	5.0
	22	16 x 20	245	223	0.25	57229E3	7.5	67229E3	7.5	-	-	37229E3	7.5
	33	16 x 25	325	322	0.25	57339E3	7.5	67339E3	7.5	-	-	37339E3	7.5
	47	16 x 35	420	448	0.25	57479E3	7.5	67479E3	7.5	-	-	-	-



ADDITIONAL ELECTRICAL DATA		
PARAMETER	CONDITIONS	VALUE
<b>Voltage</b>		
Surge voltage		$U_s \leq 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1 \text{ V}$
<b>Current</b>		
Leakage current	After 2 min at $U_R = 10 \text{ V to } 100 \text{ V}$	$I_{L2} \leq 0.01 C_R \times U_R \text{ or } 3 \mu\text{A, whichever is greater}$
	After 5 min at $U_R = 200 \text{ V to } 450 \text{ V}$	$I_{L5} \leq 0.03 C_R \times U_R + 15 \mu\text{A} (C_R \times U_R \leq 1000)$ $I_{L5} \leq 0.02 C_R \times U_R + 25 \mu\text{A} (C_R \times U_R > 1000)$
<b>Inductance</b>		
Equivalent series inductance (ESL)	Case $\varnothing D \leq 8 \text{ mm}$	Typ. 13 nH
	Case $\varnothing D = 10 \text{ mm}$	Typ. 16 nH
	Case $\varnothing D \geq 12.5 \text{ mm}$	Typ. 18 nH
<b>Resistance</b>		
Equivalent series resistance (ESR)	Calculated from $\tan \delta_{max}$ and $C_R$ (see Table 2)	$ESR = \tan \delta / 2 \pi f C_R$

**CAPACITANCE (C)**

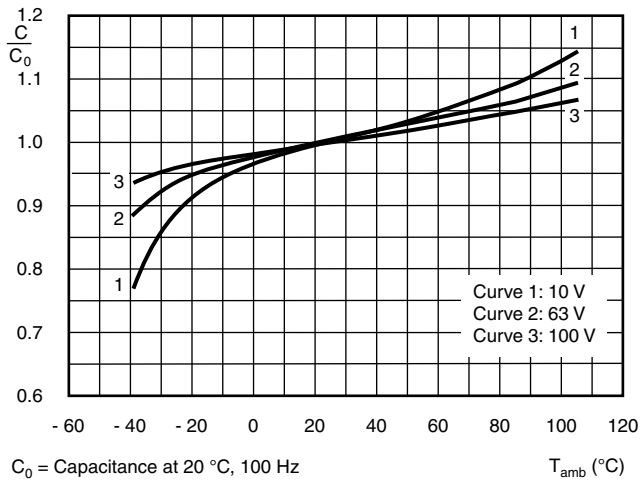


Fig. 6 - Typical multiplier of capacitance as a function of ambient temperature

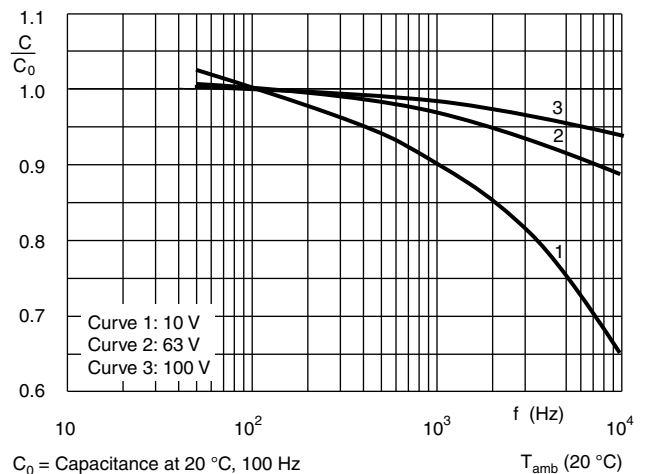
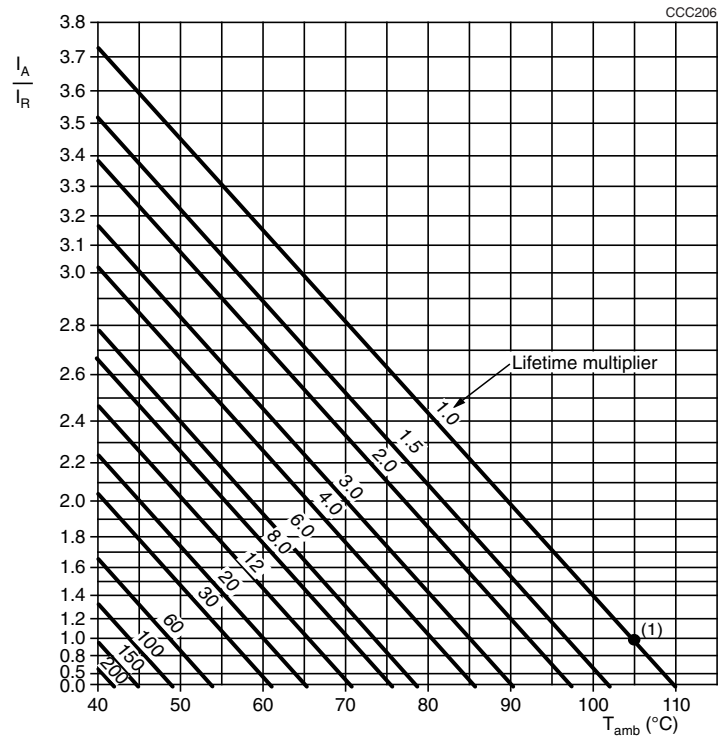


Fig. 7 - Typical multiplier of capacitance as a function of frequency

**RIPPLE CURRENT AND USEFUL LIFE**


$I_A$  = Actual ripple current at 100 Hz, 105 °C  
 $I_R$  = Rated ripple current at 100 Hz, 105 °C

(1) Useful life at 105 °C and  $I_R$  applied

Fig. 8 - Multiplier of useful life as a function of ambient temperature and ripple current load

**Table 3**

<b>MULTIPLIER OF RIPPLE CURRENT (<math>I_R</math>) AS A FUNCTION OF FREQUENCY</b>			
FREQUENCY (Hz)	$I_R$ MULTIPLIER		
	$C_R < 100 \mu\text{F}$	$C_R = 100 \mu\text{F TO } 1000 \mu\text{F}$	$C_R > 1000 \mu\text{F}$
50	0.70	0.75	0.80
100	1.00	1.00	1.00
500	1.30	1.20	1.10
1000	1.40	1.30	1.12
$\geq 10\,000$	1.50	1.35	1.15

**Table 4**

<b>TEST PROCEDURES AND REQUIREMENTS</b>			
TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 / EN130300 subclause 4.13	$T_{amb} = 105 \text{ °C}$ ; $U_R$ applied; 2000 h	$\Delta C/C: \pm 20 \%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 105 \text{ °C}$ ; $U_R$ and $I_R$ applied; 2500 h	$\Delta C/C: \pm 30 \%$ $\tan \delta \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit total failure percentage: $\leq 1 \%$
Shelf life (storage at high temperature)	IEC 60384-4 / EN130300 subclause 4.17	$T_{amb} = 105 \text{ °C}$ ; no voltage applied; 1000 h After test: $U_R$ to be applied for 30 min, 24 h to 48 h before measurement	$\Delta C/C: \pm 20 \%$ $\tan \delta \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Surge	IEC 60384-4 / EN130300 subclause 4.14	From source of $1.15 \times U_R$ ; $RC = 0.1 \text{ s} \pm 0.05 \text{ s}$ ; 1000 cycles of 30 s on, 330 s off, at 105 °C	$\Delta C/C: \pm 25 \%$ $\tan \delta \leq 1.5 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.





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